

## **DARPA R&D Annual Report**

**DARPA Order No.:**

**Contract No:** N00014-96-C-0145

**Effective Date of Contract:** June 26, 1996

**Expiration Date of Contract:** June 30, 2000

**Contractor:** General Electric Corporate Research and Development

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**Short Title of Work:** Non-toxic, Self-cleaning Silicone FR Coatings

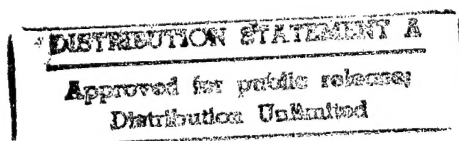
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Research began in July, 1996, on the design and development of an improved non-toxic, environmentally safe silicone fouling release coating exhibiting self-cleaning performance for the 5-7 year coating life.

Panels for waterline immersion were prepared and shipped by GE-CRD and installed at subcontractor sites for analysis of (a) the effect of oils (1) in the topcoat and (2) in the tiecoat on fouling release properties; (b) the effect of fillers on oil retention and fouling release; and (c) the effect of microencapsulated oils on oil release rates.

The tasks accomplished to date by GE CRD include preparation of 380 panels undergoing exposure testing at Bridger Scientific, SUNY Buffalo, FIT, and MMRTS; 110 samples analyzed for physical properties such as qualitative adhesion, durability, and abrasion testing; and ongoing environmental studies using radiolabeled oils. Two microcapsule manufacturers have been identified for preparation of gel wall microencapsulations.

At the DARPA downselect team meeting on May 15-16 in Ft. Lauderdale, Florida, twelve compositions were downselected for entry into phase 2, based on physical property measurements performed at CRD, barnacle adhesion data obtained from FIT and fouling data from Miami Marine Research and Testing Station. Panel preparation of the twelve downselected compositions for placement at the subcontractor's sites (7 sites) is complete and panels have been shipped.



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Metal strips coated with crosslinked RTV and  $^{14}\text{C}$  labeled PDMS have been aging in both fresh water and salt water tanks for nearly three months. Measurements of the sediment, the aqueous phase and the metal strips suggest that PDMS leaches extremely slowly from the crosslinked RTV. Similar 2-month study results were obtained from metal strips coated with  $^{14}\text{C}$  labeled SF1154. The data suggest a faster rate of depletion of SF1154 as compared to PDMS, but the rate of depletion is still very slow.

A total of 78 test panels were exposed to barnacle fouling at the Florida Institute of Technology static immersion site in January 1997 and a further 45 panels immersed in April 1997. These were caged to prevent loss of barnacles by fish predation. Two instrumented foils that measure the skin friction drag forces on panels are now in operation and calibration trials are being completed.

Panels representing four coating formulations have been immersed by Bridger Scientific at two designated utility sites (Somerset, MA and Providence, RI) for approximately four months. Test and control panels at both locations have been inspected three times (March, April, June); all have been evaluated for foul resistance and for foul release/adhesion properties where possible.

At SUNY-Buffalo, infrared spectroscopic analysis of oils used in some of the down-select coatings was completed; data will be used for calibration and interpretation of IR spectra of coating surface zones and transferred residues. Field notes, taken over the past 5 years, were reviewed for observations of the frequency and severity of grazing by fish, snails, and other species from fouling-release coatings immersed at the two test sites. It was determined that panel caging will not be necessary at these test sites. Four (4) steel control BRA640 panels were received by SUNY from NSW.

Steel panels were blasted by NSW and shipped to GE CRD for the first round of marine panel exposure tests. Control copper panels were shipped to exposure sites. A request was processed for patch testing of 3 GE promising candidates.

A work request was issued by NSW to NCCOSC for toxicity testing. Toxicology samples were made by GE CRD using (a) formulations of RTV11 + 10% oil additives and (b) a proprietary formulation were sent to NCCOSC for testing.